

## **Appendix D: Indicator Fact Sheet on nitrogen depositions**

(copy from the HELCOM web pages:

[http://www.helcom.fi/environment2/ifs/ifs2006/en\\_GB/Ndepositions/](http://www.helcom.fi/environment2/ifs/ifs2006/en_GB/Ndepositions/) )

## Atmospheric nitrogen depositions to the Baltic Sea during 1995-2004

Author: Jerzy Bartnicki, EMEP MSC-W

### *1.1.1 Key message*

The total deposition of nitrogen to the Baltic Sea in 2004 was 214 ktonnes. The annual load varies across different parts of the Baltic Sea: from 300 mg/m<sup>2</sup> N in the northern Gulf of Bothnia up to 1000 mg/m<sup>2</sup> N in the Belt Sea.

Mainly because of interannual changes in meteorology, no significant temporal pattern in nitrogen depositions to the Baltic Sea and its sub-basins can be detected in the considered period. Annual depositions of nitrogen to the Baltic Sea are oscillating around the 1995 value within 20 % range, however deposition of oxidized, reduced and total nitrogen in 2004 was respectively 15%, 9% and 13% lower than in 1995.

### *1.1.2 Results and Assessment*

#### *1.1.2.1 Relevance of the indicator for describing the developments in the environment*

This indicator shows the levels and trends in oxidized and reduced atmospheric nitrogen depositions to the Baltic Sea. The depositions of nitrogen compounds represent the pressure of emission sources on the Baltic Sea basin and catchment.

#### *1.1.2.2 Policy relevance and policy reference*

The HELCOM Ministerial Declaration of 1988 called for a 50 % reduction in discharges of nutrients to air and water by 1995 with 1987 as a base year. The 1992 Helsinki Convention and the 1998 Ministerial Declaration reaffirmed the need to further reduce discharges; leading to the adoption of several relevant Recommendations concerning measures to reduce emissions from point sources and diffuse sources. In 1990 HELCOM adopted its first Recommendation on Monitoring of Airborne Pollution Load (HELCOM Recommendation 11/1) which was later superseded by the Recommendations 14/1 and 24/1.

### *1.1.3 Assessment*

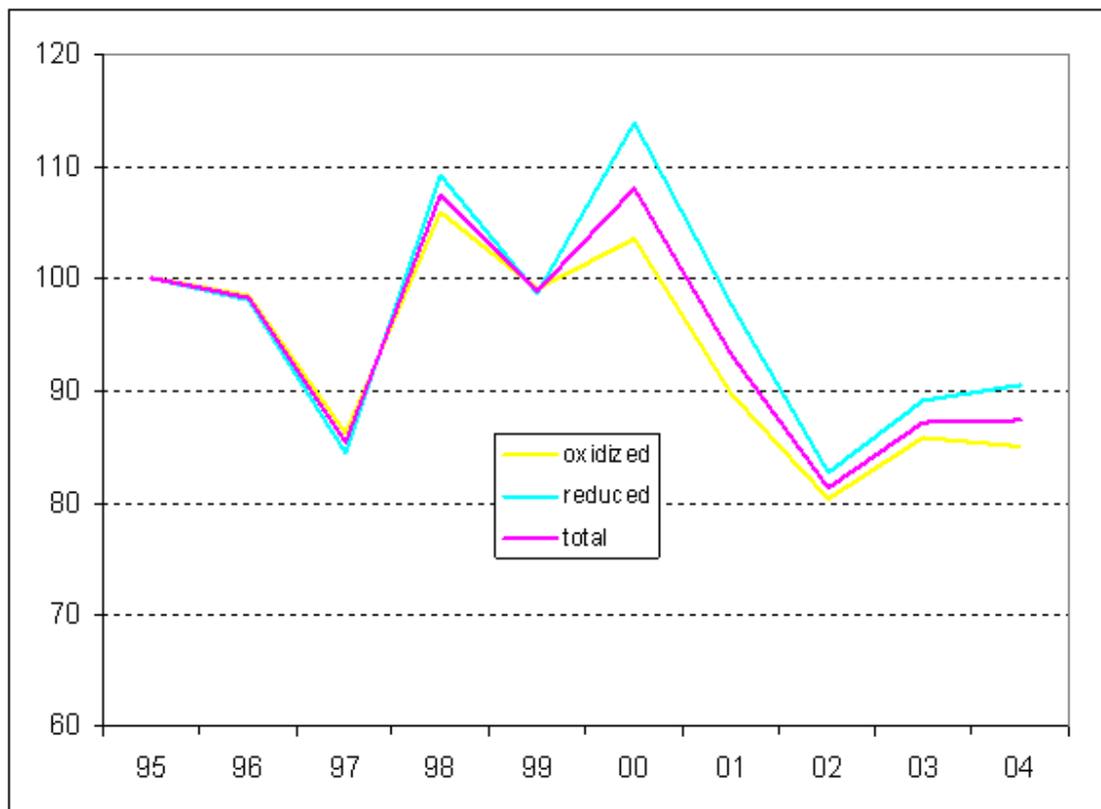
Atmospheric deposition of oxidized and reduced nitrogen was computed with the latest version of the new unified model developed at MSC-W of EMEP. The latest available emission data for the HELCOM countries have been used in the model calculations.

Calculated annual oxidized, reduced and total nitrogen depositions to the entire Baltic Sea basin in the period 1995 – 2004 are shown, in per cent of 1995 value, in **Figure 1**.

Calculated annual total nitrogen depositions to the six sub-basins of the Baltic Sea in the period 1995 – 2004 are presented in **Figure 2**.

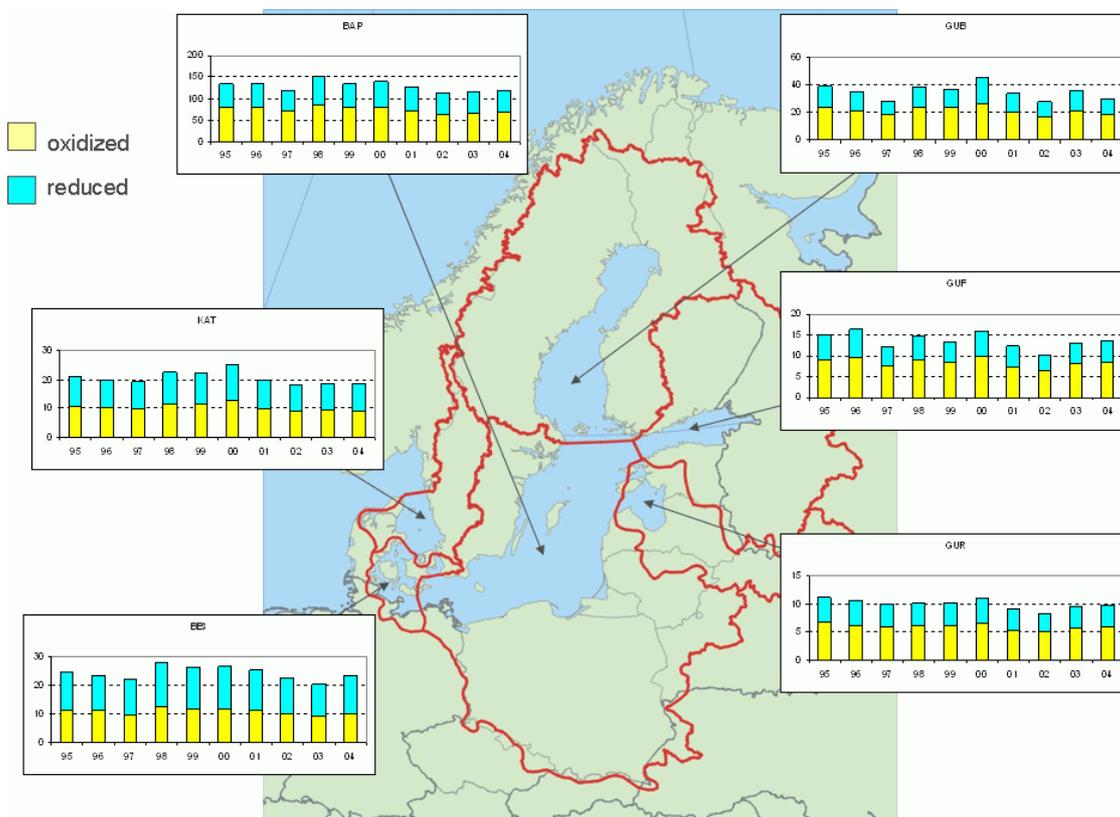
No significant trends could be determined for nitrogen loads entering the Baltic Sea or its various sub-basins.

Annual atmospheric nitrogen deposition into the Baltic Sea fluctuated at around 230 kt over the period 1995 – 2004. This total deposition consisted of slightly more (10-20%) of oxidized than reduced nitrogen.



**Figure 1.** Atmospheric deposition of oxidized, reduced and total nitrogen to six sub-basins of the Baltic Sea for the period 1995-2004, in per cent of 1995 value.

[Click the image to enlarge.](#)



**Figure 2.** Atmospheric deposition of oxidized, reduced and total nitrogen to six sub-basins of the Baltic Sea for the period 1995 - 2004. Units: ktonnes N/year. **Note:** the scales for the sea regions are different!

#### 1.1.4 Metadata

##### 1.1.4.1 Technical information

1. Source: EMEP/MSC-W.

2. Description of data: The atmospheric depositions of oxidized and reduced nitrogen were calculated with the latest version of EMEP Unified model developed at EMEP/MSC-W in Oslo. The latest available official emission data for the HELCOM countries have been used in the model computations. Emissions of two nitrogen compounds for each year of this period were officially reported to the UN ECE Secretariat by several HELCOM Contracting Parties. Missing information was estimated by experts. Both official data and expert estimates were used for modelling atmospheric transport and deposition of nitrogen compounds to the Baltic Sea - <http://webdab.emep.int/>.

3. Geographical coverage: Atmospheric depositions of oxidized and reduced nitrogen were computed for the entire EMEP domain, which includes Baltic Sea basin and catchment.

4. Temporal coverage: Timeseries of annual atmospheric depositions are available for the period 1995 – 2004.

5. Methodology and frequency of data collection:

Atmospheric input and source allocation budgets of nitrogen (oxidized, reduced and total) to the Baltic Sea basins and catchments were computed using the latest version of EMEP Unified model. EMEP Unified model is a multipollutant, three-dimensional Eulerian model which takes into account processes of emission, advection, turbulent diffusion, chemical transformations, wet and dry depositions and inflow of pollutants into the model domain. Complete description of the model and its applications is available on the web <http://www.emep.int>.

Calculations of atmospheric transport and depositions of nitrogen compounds are performed annually two years in arrears on the basis of emission data officially submitted by Parties to CLRTAP Convention and expert estimates.

#### ***1.1.4.2 Quality information***

6. Strength and weakness:

Strength: annually updated information on atmospheric input of lead, cadmium, and mercury to the Baltic Sea and its sub-basins.

Weakness: gaps and uncertainties in officially submitted by countries time series of nitrogen emissions to air

7. Uncertainty:

The results of the EMEP Unified model are routinely compared with available measurements at EMEP and HELCOM stations. The comparison of calculated versus measured data indicates that the model predicts the observed air concentrations of lead and cadmium within the accuracy of approximately 30%.

8. Further work required:

Further work is required on reducing uncertainties in emission data and better parameterization of physical processes in the EMEP Unified model.

**For reference purposes, please cite this indicator fact sheet as follows:**

[Author's name(s)], [Year]. [Indicator Fact Sheet title]. HELCOM Indicator Fact Sheets 2006. Online. [Date Viewed], [http://www.helcom.fi/environment2/ifs/en\\_GB/cover/](http://www.helcom.fi/environment2/ifs/en_GB/cover/).

Last updated 26 Sep 2006.